

PATENT COOPERATION TREATY

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INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY (Chapter II of the Patent Cooperation Treaty)

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(PCT Article 36 and Rule 70)

Applicant's or agent's file reference 20031010	FOR FURTHER ACTION See Form PCT/IPEA/416	
International application No. PCT/FI 2004/000085	International filing date (day/month/year) 24.02.2004	Priority date (day/month/year) 26.02.2003
International Patent Classification (IPC) or national classification and IPC C22B 3/08 // C22B 19:00		
Applicant Outokumpu Oyj et al		

1. This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36.
2. This REPORT consists of a total of 3 sheets, including this cover sheet.
3. This report is also accompanied by ANNEXES, comprising:
 - a. ☒ (sent to the applicant and to the International Bureau) a total of 3 sheets, as follows:
 - ☐ sheets of the description, claims and/or drawings which have been amended and are the basis of this report and/or sheets containing rectifications authorized by this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions).
 - ☐ sheets which supersede earlier sheets, but which this Authority considers contain an amendment that goes beyond the disclosure in the international application as filed, as indicated in item 4 of Box No. I and the Supplemental Box.
 - b. ☐ (sent to the International Bureau only) a total of (indicate type and number of electronic carrier(s)) _____, containing a sequence listing and/or tables related thereto, in computer readable form only, as indicated in the Supplemental Box Relating to Sequence Listing (see Section 802 of the Administrative Instructions).

4. This report contains indications relating to the following items:

<input checked="" type="checkbox"/>	Box No. I	Basis of the report
<input type="checkbox"/>	Box No. II	Priority
<input type="checkbox"/>	Box No. III	Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
<input type="checkbox"/>	Box No. IV	Lack of unity of invention
<input checked="" type="checkbox"/>	Box No. V	Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
<input type="checkbox"/>	Box No. VI	Certain documents cited
<input type="checkbox"/>	Box No. VII	Certain defects in the international application
<input type="checkbox"/>	Box No. VIII	Certain observations on the international application

Date of submission of the demand 20.12.2004	Date of completion of this report 04.05.2005
Name and mailing address of the IPEA/SE Patent- och registreringsverket Box 5055 S-102 42 STOCKHOLM Facsimile No. +46 8 667 72 88	Authorized officer Mårten Hulthén/MP Telephone No. +46 8 782 25 00

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.

PCT/FI 2004/000085

Box No. I Basis of the report

1. With regard to the language, this report is based on the international application in the language in which it was filed, unless otherwise indicated under this item.

☐ This report is based on a translation from the original language into the following language _____, which is the language of a translation furnished for the purposes of:

- ☐ international search (under Rules 12.3 and 23.1(b))
☐ publication of the international application (under Rule 12.4)
☐ international preliminary examination (under Rules 55.2 and/or 55.3)

2. With regard to the elements of the international application, this report is based on *(replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report)*:

☐ the international application as originally filed/furnished

☒ the description:

pages 1 - 10 _____ as originally filed/furnished

pages* _____ received by this Authority on _____

pages* _____ received by this Authority on _____

☒ the claims:

pages _____ as originally filed/furnished

pages* _____ as amended (together with any statement) under Article 19

pages* 12 - 14 _____ received by this Authority on 14.3-2005

pages* _____ received by this Authority on _____

☒ the drawings:

pages 1 _____ as originally filed/furnished

pages* _____ received by this Authority on _____

pages* _____ received by this Authority on _____

☐ a sequence listing and/or any related table(s) – see Supplemental Box Relating to Sequence Listing.

3. ☐ The amendments have resulted in the cancellation of:

- ☐ the description, pages _____
☐ the claims, Nos. _____
☐ the drawings, sheets/figs _____
☐ the sequence listing (*specify*): _____
☐ any table(s) related to the sequence listing (*specify*): _____

4. ☐ This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).

- ☐ the description, pages _____
☐ the claims, Nos. _____
☐ the drawings, sheets/figs _____
☐ the sequence listing (*specify*): _____
☐ any table(s) related to the sequence listing (*specify*): _____

* If item 4 applies, some or all of those sheets may be marked "superseded."

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.

PCT/FI 2004/000085

Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Claims	<u>1-14</u>	YES
	Claims		NO
Inventive step (IS)	Claims	<u>1-14</u>	YES
	Claims		NO
Industrial applicability (IA)	Claims	<u>1-14</u>	YES
	Claims		NO

2. Citations and explanations (Rule 70.7)

Amended claims 1-14 were filed on 14 March 2005.

Document considered as being of particular relevance:
D1 US 4252775

The invention reveals a method for recovery of zinc in which zinc calcine and zinc sulphide concentrate are leached in three stages, and in which the sulphuric acid content of the stages rises in accordance with the direction in which the solids are moving. The solids and the solution formed in the leaching stages are directed throughout the process counter-currently in relation to each other. This decreases the demand for neutralisation and also the need for a multi-stage process.

D1 (e.g. claim 1) discloses a process for treating residues from a primary leaching of ferriferous zinc ores by sulphuric acid. It involves counter-current leaching in three stages. However, the method of the invention differs from D1 in that it involves a zinc sulphide concentrate as a starting material. Further, iron is precipitated in the second leaching stage. Consequently, the method according to claims 1-14 is novel.

The stated differences imply improvements in obtaining a simpler process for leaching zinc-containing materials. Consequently, the invention is considered to involve an inventive step and also to fulfil the criteria of industrial applicability.

PATENT CLAIMS

1. A method for a recovery of zinc from zinc calcine and zinc sulphide concentrate in connection with an electrolytic precipitation of zinc, whereby a zinc sulphate solution obtained from the first leaching stage is directed via solution purification to zinc electrolysis and the iron contained in the raw materials is precipitated as jarosite, **characterised in that** leaching of zinc calcine and zinc sulphide concentrate is performed in three stages in atmospheric conditions and at a temperature between 80 °C and the boiling point of the solution, whereby the solids and solution move countercurrently in relation to each other and the acid content of the leaching stages rises in the direction of the flow of the solids, wherein the concentrate leaching and iron precipitation take place in the second stage.
2. A method according to claim 1, **characterised in that** zinc calcine is fed to the first leaching stage, neutral leaching, where leaching is carried out in a pH range between 2 – 5.
3. A method according to claim 1 or 2, **characterised in that** zinc concentrate and the solids of the neutral leaching stage are fed to the second leaching stage and the acid content is kept in the region of 2 - 20 g/l H₂SO₄.
4. A method according to claim 3, **characterised in that** the acid content in the second leaching stage is kept in the region of 5 – 15 g/l.
5. A method according to any of claims 1 - 4, **characterised in that** the solids of the concentrate leaching and jarosite precipitation

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stage are routed to the final stage of leaching, a conversion stage, in which the acid content is kept in the region of 25 -70 g/l H_2SO_4 .

5 6. A method according to claim 5, **characterised in that** the acid content in the final leaching stage is kept in the region of 30 – 50 g/l.

10 7. A method according to any of claims 1 – 6, **characterised in that** the zinc calcine is leached in the neutral leaching stage using the solution containing zinc sulphates and iron sulphates taken from the concentrate leaching and jarosite precipitation stage and return acid from electrolysis.

15 8. A method according to claim 7, **characterised in that** oxygen and/or air is fed into the neutral leaching stage in order to oxidise the ferrous iron and precipitate it as hydroxide $\text{Fe}(\text{OH})_3$, which co-precipitates the harmful minerals in the solution.

20 9. A method according to claim 8, **characterised in that** the harmful minerals are germanium and antimony.

25 10. A method according to any of claims 1 – 9, **characterised in that** the leaching in the concentrate leaching and jarosite precipitation stage is performed using oxygen and/or air and the acidic sulphate solution containing zinc and iron from the conversion stage.

30 11. A method according to any of claims 1 – 10, **characterised in that** the acid level in the concentrate leaching and jarosite precipitation stage is adjusted using return acid.

12. A method according to any of claims 1 - 11, **characterised in that** alkali or ammonium ions are fed into the concentrate leaching and

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jarosite precipitation stage in order to precipitate the jarosite as alkali or ammonium jarosite, and that jarosite nuclei are recirculated within the stage.

- 5 13. A method according to any of claims 1 – 12, **characterised in that** the solids remaining from the concentrate leaching and jarosite precipitation stage, which contain undissolved ferrites, part of the concentrate and the generated jarosite, are leached in the conversion stage using oxygen and electrolysis return acid in order
10 to leach the ferrites and end concentrate and to precipitate the dissolved iron as jarosite.
14. A method according to any of claims 1 – 13, **characterised in that** flotation is performed on the solids formed during the concentrate
15 conversion stage in order to form sulphur concentrate.